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ABSTRACT

In an effort to learn at which level of language proficiency English for Special Purposes can be taught effectively to nonnative speakers, 50 students at an electronics institute in Algeria were administered eight tests after a 16-week intensive English course. Four of the tests were of skills in English as a second language (ESL): the grammar sections of the Michigan Proficiency Exam, a 100-item multiple-choice listening comprehension test, a cloze test of brief ESL passages, and ESL dictations. Four tests were of technical language, designed by and with passages submitted by the technical faculty, including a 50-item multiple-choice technical grammar test, reading passages, cloze tests of brief passages, and dictations. It was found that the tests of ESL correlated significantly with the technical language tests. During the next semester, structure and listening tests were administered and the results analyzed to determine the predictability of the learner's future technical performance. It was found that the ESL tests predicted ESL performance slightly better than the ESP tests, while the integrative cloze and dictation tests appeared to be better indicators of a learner's ability to succeed in technical subjects. (MSE)

Testing in an EFL/ESP Context

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ABSTRACT

There has been much discussion concerning the level of language proficiency at which ESP (English for Special Purposes) can most efficiently and effectively be taught to non-native speakers.

In an effort to find answers to this question, instructors at the National Institute of Electricity and Electronics in Boumerdes, Algeria, administered eight tests to 50 students who had completed a sixteen week intensive EFL program. Four of the tests were of EFL content: 1) the grammar sections of the Michigan Proficiency Exam (A and B), 2) a 100-item multiple-choice listening comprehension exam, 3) 3 short EFL cloze passages and 4) 2 EFL dictations. Four tests were of ESP content, with the passages submitted by the technical faculty and produced in a testing format by the EFL staff: 1) a fifty-item multiple-choice technical grammar test, 2) 8 reading passages, 3) 3 short ESP cloze passages and 4) 2 ESP dictations. All results were correlated and factor-analyzed.

It was found that tests of EFL content correlated significantly with tests of ESP content, indicating similarity of students' scores, regardless of content. Furthermore, the factor analysis revealed all tests to be similar in that they assessed general language ability.

The following semester CELT Structure and Listening Tests were administered and the learners' final technical subject scores were collected. The scores were related to the students' previous EFL/ESP tests by regression analysis to determine the predictability of a learner's future technical performance. It was found that EFL tests predicted a student's EFL performance slightly better than the ESP tests, while the integrative tests of cloze and dictation appeared to be better indicators of a learner's ability to succeed in technical subjects.

English for Specific Purposes (ESP) enjoys a great prestige in ESL/FL. ESP rests on "a reputation for relative high success rates . . . compared with conventional teaching of English as a foreign language." (Strevens 1977:3) In terms of establishing a coherent ESP curriculum with a learner-centered approach, impressive work has been done in identifying the learner's linguistic/communicative needs (see, for example, Jones and Roe 1975; Mackay 1978; and Munby 1977). Ewer (1975) provides an excellent discussion of the need for trained EST (English for Science and Technology) instructors.

When evaluation is taken into account, however, very little has been done in assessing an ESP program.

> "It remains a major shortcoming of ESP that very little work has been done to devise fresh methods fo testing, examing and assessment that match the new courses of training. ESP teachers combine in rejecting as unsuitable all of the many existing tests in ESL. (British Council 1976)." (Strevens 1977:129)

The paucity of adequate evaluation of both learner and curriculum presents a serious drawback to ESP: If there is no evaluation of the teaching/learning to provide feedback and subsequent adjustment of the curriculum, then the curriculum is significantly handicapped, a fact which may be a source of frustration to both the instructor and the learner.

The assumptions of the teaching/learning of ESP/EST are two: 1) The teaching learning of EST/ESP involves both science and language. "Assumed shared knowledge, . . . presupposition. . . . affects surface syntax in EST texts so drastically that language and subject matter cannot be discussed separately when the focus is on discourse." (Selinker and Trimble 1974:83) 2) ESP/EST follows a period of intensive general English in which the learner must gain a considerable command of English. This can be attested to by the

500+ score on the TOEFL or similar level of proficiency needed by the learner before studying ESP/EST. In addition, many ESP/EST programs are designed for the post-secondary (tertiary) level of education, a time when the learners have completed many years of English.

Given these assumptions, what can an EFL/SL teacher, transformed into an ESP/EST instructor, do when his learners do not meet the proficiency criteria of assumption 2? What should the instructor do when the learners do not have a grasp of the science/technology being taught in the ESP class, let alone the language? Finally, questions within the scope of this paper are:

1) What evaluative instruments should be used?
2) What subject matter should the tests contain (general EFL or ESP)?
3) What do those instruments measure -- science or language?
4) Which instrument provides a reasonable indicator of a learner's future performance in science and technology?
5) May ESP be introduced at an earlier level of a learner's English proficiency than has previously been acknowledged?

The lack of evaluative instruments in EST/ESP may be due to the controversy concerning the relationship of scientific English to general English and to the the teaching of subject-matter as well as English in ESP/EST. The ESP/EST student is involved with "learning language and understanding science at one and the same time." (Boyd and Boyd 1978:25) It has been an effort to gain insight into the EFL-EST controversy as well as to provide satisfactory English evaluatory instruments in an ESP context that this paper has been written. "The purpose of testing is always to render information to aid in making intelligent decisions about possible courses of action." (Carroll 1972:314) To achieve these goals, the testing in this context has been the instrument of research.

The EFL-ESP controversy listed above is further compounded when current testing research is involved. Basically, the controversy in testing research centers around the conceptions of language and language learning. The criticism directed against EFL teaching/learning is that it does not expand beyond the sentence level, i.e. it does not deal with the relationship of a particular sentence to a particular piece of discourse. This focus of instruction is the heritage of structural linguistics, based upon the premise that language learning and ability may be divided into separate (discrete) skills or components. "Discrete point analysis necessarily breaks the elements of language apart and tries to teach them separately. . . with little or no attention to the way those elements interact in a larger context of communication." (Oller in press) Tests based on this premise may be called discrete-point tests, which usually employ a multiple-choice format. "The most serious disadvantage of discrete-point tests in general is that they fail (in most cases) to reflect actual language usage." (Oller 1973:185).

The other overlapping but distinct view of language and language learning holds that "to teach a language is to teach a student to communicate in real-life situations." (Oller 1973:185) Placing a stress on communicative rather than discrete skill competence is an accurate contemporary view of the English language teaching field. Tests of language use in meaningful contexts are "integrative" (Carroll 1972) or "pragmatic" tests (Oller in press).

Cloze procedure and dictation are two examples of integrative tests. As natural language is redundant, integrative/pragmatic tests exploit redundancy in a meaningful context. A cloze test reduces redundancy by a mechanical deletion of every nth word, while a dictation provides reduced redundancy via distortion. Both tests challenge the learner's internalized grammar or underlying competence of a given language. Although cloze and dictation have

generally been approved as tests of reading and listening respectively, both tests have been advocated as measures of a learner's overall language proficiency (see Aitken 1977, Oller 1972).

Working Hypotheses

As this study was exploratory in nature, a series of working hypotheses were formed on the assumption that those hypotheses could lead to progress in ESP evaluation.

The working hypotheses (WH) were as follows:

WH-1: There is a significant difference between various tests of English ability employing EFL and ESP content.

WH-2: Tests of English language ability employing ESP content measure a learner's science ability, not language ability.

WH-3: Tests of English language ability employing EFL content serve as better indicators of a learner's future EFL performance than tests having an ESP content.

WH-4: Tests of English lnaguage ability using ESP content serve as better indicators of a learner's future technical performance than English tests of EFL content.

WH-5: Integrative tests of English language ability using ESP serve as better indicators of a learner's future technical performance than discrete-point tests.

Setting

The tests developed for this study were administered to students at the Institut National d'Electricité et d'Electronique (INELEC) in Boumerdes, Algeria, in February, 1977. INELEC is a unique Algerian institution in that it is attempting to carry on an entire program in English, which is considered a foreign language, as opposed to French, the primary language of higher instruction. The students selected as subjects for this study were those who

had completed their first semester at INELEC. The first semester consisted of a 16-week intensive EFL session, totaling 480 hours. Included in the intensive semester were courses on the English of Mathematics (80 hours) and the English of Tools (80 hours). In addition, after eight weeks the students were given an introduction to electricity (40 hours) and technical drawing (40 hours), courses which were taught by technical instructors in English.

This setting proved interesting for five reasons: 1) Almost all subjects had either Arabic or Arabic/Kabylie Berber as a first language, with French as a second language. The only exception was a student of Algerian parentage raised in France, who spoke French as a first language and Arabic as a second language. 2) All students had a relatively similar education in primary and secondary educational institutions. 3) All subjects had some prior English language experience, usually taught by non-native speakers with a traditional grammar orientation. Subjects could talk about grammar, but not use English for communicative purposes. Entrance tests classified students at the false beginner or low intermediate level. 4) Students entering INELEC were selected in terms of scientific and mathematical ability and not English. 5) None of the subjects had had previous training in electrical technology or engineering.

Subjects

Fifty students who had completed their first and second semester in Electrical Technology were selected for this study. Although 62 students had taken the English tests at the end of the first semester, subjects were dropped who were not passed to the second semester, who changed fields of study or did not complete the battery of tests.

Tests Instruments (see Figure 1)

All the English tests used may be classified into the categories of grammar, listening and reading. With the exception of the Michigan Test of

Language Proficiency (MTELP)-Grammar sections (A and B-Revised) and the teacher constructed listening comprehension test, all of the tests may be found in Appendix A. The following is a description of the eight tests which were administered.

EFL

1) MTELP-Grammar (80 items) The grammar section of the MTELP, Form A (1961) and Form B-Revised (1965) were used.

2) Listening Comprehension (100 items) The listening comprehension was teacher constructed. Using a multiple-choice format, utterances required either an appropriate response or paraphrase. This type of listening test was similar to most standardized tests of listening comprehension.

3) Cloze Procedure (66 items) A set of three cloze passages with seventh word deletions were used. The passages were selected from grade school and junior high reading for native English speakers. Scoring was based on the exact and acceptable word method.

4) Dictation (310 items) Two dictations, taken from grade school - junior high reading, were administered. Scoring was based on the exact word method, one point for each correct word inclusive of minor spelling errors.

ESP/EST

In developing the EST tests, the technical faculty was asked to submit two passages from their own coursework which they felt the subjects would be able to understand in terms of language and not specific scientific/technical concepts. From those passages received, items were selected to construct a discrete-point grammar test, two cloze passages and two dictations.

1) Technical Grammar (50 items) This test was constructed by the English teachers compiling a list of structures that were taught in the intensive semester and then matching a technical sentence carrying the item. The structure

Figure One

Tests

Skill/Focus Tested:	Context	Items	Type	Context	Items	Type
	EFL			ESP/EST		
Grammar:	Mich A+B	80	discrete-point	Tech Grammar*	50	discrete-point
Listening:	Listening	100	discrete-point			
	Dictation*	301	integrative	Dictation*	242	integrative
Reading:	Cloze*	66	integrative	Cloze*	79	integrative
				Reading Comprehension*	32	discrete-point

*These tests may be found in Appendix A.

to be tested was then omitted and placed in a multiple-choice format with distractors created by the English instructors. Due to a limited number of technical passages received by the English staff, a few items in the grammar test were solely the creation of the English faculty. Those items, however, contained technical classroom content.

2) ESP/EST Reading Comprehension (32 items) Eight short reading passages, submitted by an English of Tools instructor, were administered. Each passage was followed by four comprehension questions in a multiple-choice format.

3) ESP/EST Cloze Procedure (79 items) Two passages were selected from those submitted by the technical faculty and were administered with a seventh word deletion. Another passage, submitted by an English of Tools instructor, was included. Scoring was by the exact and acceptable word method.

4) ESP/EST Dictation (242 items) Two passages were selected from those submitted by the technical faculty. Scoring was based on one point for each correct word, inclusive of minor spelling errors.

Procedure

All subjects were given various tests at different times during the examination week of the first semester. The logistics of providing one test at a time to all subjects proved impossible. All tests and answers were collected at the end of each test period. All subjects had practice in cloze procedure and dictation prior to the examination.

At the end of the subjects' second semester, final scores for the subjects' technical courses were collected. The technical courses were Mathematics, Technical Drawing and D-C Circuitry. The subjects were also given the Comprehensive English Language Test (CELT): Listening (Form L-A, 1970) and Structure.

Statistical Procedure

All results of the first semester were correlated and factor analyzed, using Pearson product-moment correlation (r) and principal component

analysis. The use of r and factor analysis permitted testing of WH-1 and WH-2.

A correlation indicates the associative relationship (if any) between two variables. The correlation squared (r^2) indicated the amount of variance shared by two variables. "Factor analysis is one of the statistical techniques for examining . . . patterns of correlation." (Oller and Hinofotis 1976:1) Highly correlated variables form (or load on) a factor. It may be hypothesized that the variables on a factor share a common or underlying source. What is of importance is the amount of loading of each variable on a factor, which indicates the factor's importance to a variable. Using a principal components solution, if a general or common factor, G, indicating similarity between variables, is to be accepted, the product between two variable loadings (predicted r) should equal the actual correlation between them. The remaining (residual) variance between the two variables should be near or at zero.

To test WH-3, WH-4 and WH-5 the scores of the eight tests administered at the end of the first semester were correlated with the technical and English test scores of the second semester. With each of the scores of the second semester serving as dependent variables and each of the English tests of the first semester serving as independent variables, a simple linear regression was calculated to determine which one of the eight English tests would be the best predictor for each of the dependent variables.

Given the correlation between two variables, simple regression analysis provides the "best" prediction possible. (Kerlinger 1973:604) From a one-way analysis of variance, the F-ratio may be found indicating the statistical significance of the regression, of predicting Y (the dependent variable) from X (the independent variable).

Results and Discussion

The mean, standard deviation, standard error of measurement and reliability estimates of all tests may be found in Table 1. The correlation matrix for the EFL/ESP tests may be found in Table 2a. Table 2b contains the correlation matrix of technical scores. Table 3a contains the factor analysis and calculated loading of the EFL/ESP tests. Table 3b contains a comparison of predicted correlations from the factor loading with the actual correlations. Table 3c contains the remaining variance not accounted for by the factor loadings.

The correlations found in Table 2a reveal that there is a good deal of shared variance between the Total EFL and Total ESP tests ($r = .88$, $r^2 = .77$). This high correlation indicates that there is little significance attributed to content with regard to a subject's score. It appears that EFL tests of one skill generally correlate more highly with ESP tests of the same skill than other tests of different skills or content. The Michigan Grammar test correlates most closely with the Technical Grammar test ($r = .79$). Listening Comprehension correlates highly with Dictation EST ($r = .64$). Cloze EFL correlates most highly with Cloze EST ($r = .69$). The test with the poorest correlations appears to be the Reading Comprehension-EST test, which also has a low reliability.

The factor analysis reveals a single unitary factor accounting for 100% of the variance in the total matrix. All the variables may then be hypothesized as tests of general language ability. All variables load highly on the G factor with the exception of the Reading Comprehension test ($h^2 = .40$). The residual variance (Table 3c) indicates that only a small amount of variance remains unaccounted for by the G factor.

The factor analysis does not reveal different skill areas with unique variance. If this were the case, various factors would be produced, corresponding to a skill. In this study, the tests of grammar, listening and

reading would produce three different factors. Furthermore, if there were also a difference between language content and skill, there would be six factors: one for EFL Grammar, one for Tech Grammar, and so on. If the EST tests measured science and not language ability, then there would be two factors: one for science, containing the ESP tests and one for language, containing the EFL tests. The data, however, do not support any of these conditions. Rather, they appear to support the unitary competence hypothesis (Oller and Hinofotis 1976; Scholz, Hendricks, et al. 1977) that "The components of language competence, whatever they may be, may function more or less similarly in any language-based task." (Oller and Hinofotis 1976:2)

Table 4a contains the correlations and F-ratios of the regression analysis of the English CELT tests on the eight EFL/ESP tests. Table 4b contains the correlations and F-ratios of the regression analysis of the technical scores on the English tests.

All regressions of the English tests were significant at the .01 level with the exception of the CELT Structure Test on Cloze-EST (p less than .05). Tests of grammar correlated most highly with the CELT Structure test, (Table 4a-1) although Michigan Grammar corrleated slightly higher than the Tech Grammar. Tests of listening correlated most highly with the CELT Listening test, (Table 4a-2) although the EFL Listening Comprehension correlated slightly higher than Dictation-EST. In regard to the Total CELT scores, (Table 4a-3) both discrete-point and integrative tests, regardless of EFL or ESP content, appeared to serve as indicators of a subject's future English ability.

With respect to the regression analysis of the technical scores on the eight English tests (Table 4b), the picture is not so clear. The Cloze-EST test correlates the highest of all the English tests with the Technical scores, with the exception of D-C Circuitry. However, the regression analysis

was not significant at the .05 level. Cloze and dictation, integrative tests, served as slightly better indicators than the discrete-point tests of grammar.

One problem with the regression analysis may be that the technical scores were not accurate representations of the subjects' technical performance. Other factors besides technical ability may have been taken into account in the final technical score calculations. The assumption that knowledge of English would have no bearing at all in an entirely English academic program seems tenuous.

To explore the relationship of EFL/ESP to future technical performance further, the subjects with the highest scores in technology were examined. The criterion was that the subject had to have scored one standard deviation or better on three or more of the technical scores.* Nine subjects met the criterion. The results may be found in Table 5. Although very few of the regressions are statistically significant at the .05 level, the correlations are much larger. Cloze-EST still maintains the highest correlation with the technical scores. Both grammar tests and the Listening Comprehension test do not appear to predict as well as some of the integrative tests of cloze and dictation. In terms of technical performance, it appears that in the case of the regression of all subjects (Table 4b-4) and of the top subjects (Table 5d) Cloze-EST and Dictation-EFL are the best predictors of the eight English tests.

Conclusions and Recommendations

Tests containing either EFL or ESP measure general language ability. The ESP/EST tests used in this study assess language and not science. EFL

*One exception was Technical Drawing, where the criterion was a score of 95 or better.

tests are slightly better indicators of a learner's future EFL performance than ESP tests.

In terms of predicting technical socres, more research is needed to determine EFL/ESP tests that are able to indicate future technical performance at a statistically significant level. This study speculates that integrative tests may serve as better indicators of technical performance than discrete-point tests. An integrative/pragmatic test in an EST context is probably more valid than a discrete-point test, as "the validity of the test can be established not solely on the basis of whether it appears to involve a good sample of the English language but <u>more on the basis of whether it predicts success in the learning tasks and social situations to which the examinees will be exposed</u>. (emphasis mine)" (Carroll 1972:319)

The integrative tests of EST-Cloze and Dictation-EFL may indicate that, in a technical context, listening and reading are significant language skills. It may be that while the learner may have to read his technical books, the technical instructor simplifies his scientific information into everyday English. As Michael Collins of the EFL staff of the University of Petroleum and Minerals asserts after observing the language of science lectures at his university,

> "The need for communication forces the science teacher to explain difficult or unfamiliar terms and concepts by reference to everyday examples in everyday language and this is the kind of language he uses most of the time." (Boyd and Boyd 1978:25)

Needless to say, the development of reliable and valid tests for learners in an ESP context remains necessary. It is hoped that the statistical analysis and ideas in this paper may help this development.

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Table 1

I. Semester I

Test	Items	Mean	Standard Deviation	Standard Error of Measurement	Reliability (r_{11})*
Mich Grammar	80	41.84	7.37	4.42	.64
Listening	100	64.88	9.25	4.71	.74
Cloze EFL	66	39.04	8.88	4.87	.81
Dictation EFL	301	130.22	31.56	8.41	.93
Total EFL	547	272.40	51.37	11.50	.95
Tech Grammar	50	29.38	6.71	3.38	.75
Reading Comp EST	32	17.96	4.83	2.72	.68
Cloze EST	79	48.70	10.12	4.20	.83
Dictation EST	242	136.48	27.30	7.53	.92
Total EST	403	232.18	42.14	9.71	.95

II. Semester II

English					
CELT Structure	75	41.84	7.37	4.23	.67
CELT Listening	50	26.44	5.36	3.47	.58
CELT Total	125	63.48	11.02	5.51	.75
Technical					
Math	100	53.98	18.08	4.78	.93
DC Circuits	100	58.74	9.57	4.88	.74
Technical Drawing	100	86.18	16.61	2.88	.97
Total Technology	300	198.96	37.54	7.51	.96

*Kuder-Richardson reliability approximation taken from Introduction to Research in Education, D. Ary, L. Jacobs, A. Razavieh. New York: Holt, Rhinehart & Winston, 1972, p. 207-208.

Table 2a

Correlation Matrix of Four EFL and Four ESP/EST tests; Observed r above diagonal and Common Variance (r^2) below diagonal.

	1	2	3	4	5	6	7	8	9	10
1 Mich Grammar		.62	.60	.62	.79	.79	.53	.63	.62	.73
2 Listening	.38		.53	.44	.64	.57	.63	.51	.64	.70
3 Cloze EFL	.36	.28		.43 (.002)	.57	.66	.50	.69	.51	.65
4 Dictation EFL	.38	.19	.18		.91	.57	.30 (.033)	.68	.77	.77
5 Total EFL	.62	.41	.32	.83		.76	.50	.78	.81	.88
6 Tech Grammar	.62	.32	.44	.32	.58		.58	.72	.61	.78
7 Reading Comp EST	.28	.40	.25	.09	.25	.34		.47	.43 (.002)	.60
8 Cloze EST	.40	.26	.48	.46	.61	.52	.22		.66	.83
9 Dictation EST	.38	.41	.26	.59	.66	.37	.18	.44		.95
10 Total EST	.53	.49	.42	.59	.77	.61	.36	.69	.90	

p is less than .001 unless indicated.

Table 2b

Correlation Matrix of Technical Scores Observed r above diagonal and Common Variance (r^2) below diagonal. (N=50)

	1	2	3	4
1 Math		.61	.60	.90
2 DC Circuits	.37		.45	.75
3 Technical Draw	.36	.20		.85
4 Total Tech	.81	.56	.72	

p is less than .001.

Table 3a

I. Principal Factor Solution (with iterations) for the four EFL tests and four EST tests (N=50 Algerian subjects).

Tests	Loadings on G Factor*	h^2
Michigan Grammar	.83	.69
Listening	.73	.53
Cloze EFL	.73	.53
Dictation EFL	.72	.52
Technical Grammar	.86	.74
Reading Comprehension EST	.63	.40
Cloze EST	.82	.67
Dictation EST	.80	.64
	Eigen value	4.72

*Accounts for 100% of the total variance in the factor matrix.

II. Number of Factors in Varimax Rotation less than two, so Rotation Bypassed.

Table 3b

Correlation Matrix (above the diagonal) and Predicted Correlations Derived from Respective Products of Loadings on G (below diagonal).

	1	2	3	4	5	6	7	8
1 Mich Gram		.79	.53	.62	.60	.63	.62	.62
2 Tech Grammar	.71		.58	.57	.66	.72	.61	.57
3 Reading Comp EST	.52	.54		.63	.50	.47	.43	.30
4 Listening	.61	.63	.46		.53	.51	.64	.44
5 Cloze EFL	.61	.63	.46	.53		.69	.51	.43
6 Cloze EST	.68	.71	.52	.60	.60		.66	.68
7 Dictation EST	.66	.69	.50	.58	.58	.66		.77
8 Dictation EFL	.60	.62	.45	.53	.53	.59	.58	

Table 3c

Residual Matrix with G Loading Partialed Out (mean of absolute values = .0625): Observed r minus Product of Loading on G.

	1	2	3	4	5	6	7	8
1 Mich Gram		.08	.01	.01	-.01	-.05	-.04	.02
2 Tech Grammar			.04	-.06	.03	.01	-.08	-.05
3 Reading Comp EST				.17	.04	-.05	-.07	-.15
4 Listening					.00	-.09	.06	-.09
5 Cloze EFL						.09	-.07	-.10
6 Cloze EST							.00	.09
7 Dictation EST								.19
8 Dictation EFL								

Table 4a

Linear Regression Analysis of English Tests (N=50)

4a-1 Dependent Variable: CELT Structure

Source (in order of correlation)	r	r^2	Sum Squares-Regression (df=1)	Sum Squares Residual (df=48)	F
1 Mich Grammar	.69	.48	1096	1326	39.67*
2 Tech Grammar	.69	.47	1014	1306	37.27*
3 Listening Comp	.52	.27	504	1818	13.31*
4 Dictation EST	.48	.23	639	1880	16.31*
5 Cloze EFL	.46	.21	510	1556	15.73*
6 Dictation EFL	.45	.20	640	1948	15.77*
7 Cloze EST	.41	.16	185	1374	6.46**
8 Reading Comp EST	.34	.11	965	2216	20.90*

4a-2 Dependent Variable: CELT Listening

Source (in order of correlation)	r	r^2	Sum Squares-Regression (df=1)	Sum Squares-Residual (df=48)	F*
1 Listening Comp	.68	.47	583	784	35.69
2 Dictation EST	.63	.40	456	858	25.21
3 Dictation EFL	.62	.39	556	860	31.03
4 Cloze EST	.52	.28	651	1056	29.59
5 Mich Grammar	.50	.25	262	1040	12.09
6 Tech Grammar	.48	.23	375	1100	16.36
7 Reading Comp EST	.43	.18	401	1146	16.80
8 Cloze EFL	.40	.16	342	1186	13.84

*p is less than .01
**p is less than .05

Table 4a (continued)

4a-3 Dependent Variable: CELT Total

Source (in order of correlation)	r	r^2	Sum Squares-Regression (df=1)	Sum Squares-Residual (df=48)	F*
1 Mich Grammar	.69	.47	3878	3152	59.06
2 Tech Grammar	.67	.45	2158	3438	30.13
3 Listening Comp	.66	.44	2829	3392	40.03
4 Dictation EST	.62	.38	2246	3700	29.14
5 Dictation EFL	.59	.35	2467	3770	31.41
6 Cloze EST	.52	.27	1441	4372	15.82
7 Cloze EFL	.49	.24	1940	4616	20.17
8 Reading Comp EST	.42	.18	952	5204	8.78

*p is less than .01

Table 4b

Linear Regression Analysis of Technical Course Grades (N=50)

4b-1 Dependent Variable: Math

Source (in order of correlation)	r	r^2	Sum Squares-Regression (df=1)	Sum Squares-Residual (df=48)	F
1 Cloze EST	.23	.05	823	14,764	2.68
2 Reading Comp EST	.09	---+	-406	15,926	------
3 Cloze EFL	.07	---+	194	15,994	------
4 Dictation EFL	.07	---+	-250	15,878	------
5 Dictation EST	.07	---+	180	15,338	------
6 Mich Grammar	.06	---+	69	15,824	------
7 Tech Grammar	.05	---+	-57	16,096	------
8 Listening Comp	.01	---+	108	16,010	------

+less than .01

Table 4b (continued)

4b-2 Dependent Variable: D-C Circuitry

Source (in order of correlation)	r	r^2	Sum Squares-Regression (df=1)	Sum Squares Residual (df=48)	F
1 Listening Comp	-.25	.06	284	4214	3.23
2 Cloze EST	.07	---+	256	4438	2.77
3 Cloze EFL	.06	---+	143	4466	1.54
4 Reading Comp EST	-.03	---+	-107	4496	----
5 Mich Grammar	-.03	---+	361	4446	3.90
6 Tech Grammar	-.03	---+	361	4454	3.89
7 Dictation EST	-.03	---+	478	4418	5.19**
8 Dictation EFL	-.02	---+	1180	4438	12.76*

4b-3 Dependent Variable: Technical Drawing

Source (in order of correlation)	r	r^2	Sum Squares-Regression (df=1)	Sum Squares-Residual (df=48)	F
1 Cloze EST	.31	.09	366	12,284	1.43
2 Dictation EFL	.27	.07	1526	12,336	5.94**
3 Cloze EFL	.20	.04	1400	13,052	5.15**
4 Mich Grammar	.18	.03	115	12,990	----
5 Dictation EST	.11	.01	10	20,558	----
6 Tech Grammar	.07	---+	69	13,526	----
7 Reading Comp EST	-.08	---+	103	13,446	----
8 Listening Comp	-.04	---+	27	13,360	----

*p is less than .01
**p is less than .05
+less than .01

Table 4b (continued)

4b-4 Dependent Variable: Total Technology

Source (in order of correlation)	r	r^2	Sum Squares-Regression (df=1)	Sum Squares-Residual (df=48)	F
1 Cloze EST	.27	.07	1259	62,814	.96
2 Dictation EFL	.15	.02	1195	66,976	.86
3 Cloze EFL	.14	.02	1436	67,198	1.03
4 Mich Grammar	.11	.01	1957	68,446	1.37
5 Dictation EST	.08	---*	-1216	68,232	----
6 Listening Comp	-.07	---*	392	68,210	----
7 Tech Grammar	.05	---*	605	68,895	----
8 Reading Comp EST	-.0001	--*	796	69,068	----

* is less than .01

Table 5

Linear Regression Analysis of Technical Scores of Top Subjects in Technical Courses (N=9)

5a Dependent Variable: Math

Source (in order of correlation)	r	r^2	Sum Squares-Regression (df=1)	Sum Squares Residual (df=7)	F
1 Cloze EST	.61	.37	240	428	3.93
2 Dictation EFL	.55	.31	202	452	3.13
3 Reading Comp EST	.37	.14	249	552	3.16
4 Dictation EST	.31	.10	368	574	4.49
5 Tech Grammar	.30	.09	52	606	----
6 Listening Comp	.24	.06	34	578	----
7 Mich Grammar	-.23	.05	-123	600	----
8 Cloze EFL	-.005	0	312	644	3.39

5b Dependent Variable: D-C Circuitry

Source (in order of correlation)	r	r^2	Sum Squares-Regression (df=1)	Sum Squares Residual (df=7)	F
1 Cloze EST	.63	.39	50	84	4.17
2 Cloze EFL	.58	.34	185	102	12.70*
3 Dictation EST	.56	.31	-99	98	-----
4 Reading Comp EST	.56	.31	-226	98	-----
5 Tech Grammar	.36	.13	151	126	8.38**
6 Mich Grammar	.31	.10	12	128	-----
7 Listening Comp	.30	.09	-101	114	-----
8 Dictation EFL	.06	.03	276	150	12.88*

*p is less than .01
**p is less than .05

Table 5 (continued)

5c Dependent Variable: Technical Drawing

Source (in order of correlation)	r	r^2	Sum Squares-Regression (df=1)	Sum Squares-Residual (df=7)	F
1 Cloze EST	-.70	.49	223	34	41.91*
2 Tech Grammar	-.63	.39	-161	42	-----
3 Dictation EST	-.54	.29	-211	52	28.40*
4 Listening Comp	-.50	.25	205	60	23.92*
5 Mich Grammar	-.50	.25	-171	52	-----
6 Dictation EFL	-.22	.05	195	70	19.50*
7 Cloze EFL	-.21	.04	4	68	-----
8 Reading Comp EST	-.05	---+	-380	66	-----

5d Dependent Variable: Total Technology

Source (in order of correlation)	r	r^2	Sum Squares-Regression (df=1)	Sum Squares-Residual (df=7)	F
1 Cloze EST	.51	.26	159	384	2.90
2 Reading Comp EST	.42	.18	109	512	1.49
3 Dictation EFL	.40	.16	89	506	1.25
4 Dictation EST	.29	.09	47	564	----
5 Listening	.28	.08	-430	550	----
6 Mich Grammar	-.21	.05	-444	582	-----
7 Tech Grammar	.20	.04	-456	602	-----
8 Cloze EFL	.07	---+	5	616	-----

*p is less than .01
+less than .01

Appendix A

TECHNICAL GRAMMAR

1. "You understand electronic theory very well."
"I should. I ________ it ever since I began INELEC."

   a) haven't studied
   b) had studied
   c) have been studying
   d) had been studying

2. The drawing must convey the information ________ or the part will not be made correctly.

   a) accurate and complete
   b) accuracy
   c) accurately and completely
   d) as accurate and complete

3. You ________ what happens when safety precautions aren't followed.

   a) have ever seen
   b) have never seen
   c) are usually seen
   d) can be seen

4. The charge which might exist could be ________ positive or negative depending on which material gives up electrons more easily.

   a) more
   b) either
   c) neither
   d) such

5. "Carefully inspect your circuit, checking the polarity of the leads." He said ________.

   a) to inspect your circuit carefully
   b) inspect your circuit carefully
   c) you inspect your circuit carefully
   d) not inspect your circuit carefully

6. "Don't touch that wire!" The wire is ________ dangerous to touch.

   a) much
   b) very
   c) such
   d) too

7. The word electronics derives from the electron. Electronics can ________ defined to include all applications of electricity flowing in a vacuum.

   a) for
   b) be
   c) have
   d) been

8. Ahmed ________ seen a voltmeter before he came to INELEC.

   a) had not
   b) has never
   c) hadn't been
   d) hasn't

9. When working on printed circuits, too much heat ________ soften the plastic form and cause damage.

   a) has
   b) can
   c) must
   d) has to

10. Unless the student has a clear mental picture of a letter, he ________ make the letter correctly.

   a) should
   b) shouldn't
   c) can't
   d) can

TECHNICAL GRAMMAR (continued)

11. Lithium doesn't have six electrons in its second shell, and __________ does beryllium.

a) either
b) also
c) neither
d) so

12. Inside, a glass rod supports a frame of wires __________ holds up a very thin, coiled wire, called a filament.

a) who
b) whose
c) that
d) these

13. Rosin-core flux is the solder most often used. Scientists, __________ though that flux is not a substitute for cleaning the metals to be soldered.

a) have noted
b) have been noted
c) has noted
d) have being noted

14. The secret in soldering is to heat the joint, not the solder. When the joint is __________ to melt the solder, it forms a cover without any air spaces.

a) too cold
b) enough hot
c) hot enough
d) very hot

15. In today's mass production techniques, thousands of identical parts __________ made from one drawing.

a) should be
b) can't be
c) must be
d) may be

16. If the wire __________ broken at any point, electrons would build up at the end of the wire that is connected to the negative side of the battery.

a) were
b) is
c) has
d) had

17. "How can the current be measured?"
The instructor asked __________.

a) how the current could be measured
b) if the current could be measured.
c) how could the current be measured.
d) if the current can be measured.

18. If two or more views are required, then the question of logical arrangement of the views arises. __________ drawings have three views of the object.

a) most
b) least
c) few of
d) little

19. Good drafting letters are well-proportioned. For example, the cross bar of the letter A __________ at one-third of the height of the letter.

a) should be
b) can't have
c) won't be
d) might be

TECHNICAL GRAMMAR (continued)

20. The legibility of the drawing often __________ how well the letters are made.

    a) decides
    b) is like
    c) depends on
    d) applies to

21. The polarities on the meter terminal must be observed to obtain a positive meter reading. If the connections were __________, the pointer would deflect in the reverse direction.

    a) reverse
    b) reversing
    c) reverses
    d) reversed

22. The student __________ put down the compass when the technical drawing teacher told him to stop.

    a) has already
    b) has just
    c) had just
    d) has never

23. "What kind of meter are you going to use?"
    "I'd like to use something ________ the one you are using."

    a) that
    b) like
    c) such
    d) as

24. The mathematical proof of the theorums of geometry are not ________ important to the draftsman ________ the application of these theorums to practical problems.

    a) as _____ as
    b) more _____ of
    c) most _____ of
    d) so _____ that

25. You _________ learned electronic theory. You are now ready to put it into practice.

    a) have not
    b) have yet
    c) hadn't
    d) have already

26. "Don't turn on the power before you close the switch." The directions said _______.

    a) don't turn on the power.
    b) turn on the power.
    c) not to turn on the power.
    d) to not turn on the power.

27. If you were to bring two magnets together with the north poles facing each other, you __________ feel a force of repulsion between the poles.

    a) will
    b) would
    c) won't
    d) had

28. One student works hard in his lab class. The other student ____________ works.

    a) hard
    b) hardly
    c) completely
    d) doesn't

29. Before the electric light bulb and its contents are sealed up tight, all the air __________ out and a special gas put in.

    a) had been taken
    b) are taken
    c) is taken
    d) will have been taken

TECHNICAL GRAMMAR (continued)

30. The two types are acid flux and rosin flux. Acid flux is _____ active in cleaning metals than the other.

a) least
b) as
c) more
d) that

31. "Are you going to put on your safety glasses?" He asked __________.

a) if were you going to put on your glasses.
b) where you are going to put on your glasses.
c) are you going to put on your glasses.
d) if you were going to put on your glasses.

32. The atoms of conductors have only 1 or 2 valence electrons. If you __________ at the atomic table, you can identify the good conductors.

a) looked
b) had looked
c) look
d) have been looking

33. Neon is a naturally stable element, and _________ is helium.

a) so
b) neither
c) either
d) such

34. A certain type of ohmmeter must be zeroed each time you change the range. When the adjustment ________ deflect the pointer all the way to zero, it usually means the dry cells must be replaced.

a) should not
b) might
c) cannot
d) had better

35. Recently man __________ a new form of power, atomic power.

a) are being discovered
b) had discovered
c) has discovered
d) has been discovered

36. "Did you measure the resistance?" "No. I __________ to do it during the lab hour, but I didn't have time."

a) hadn't planning
b) had been planning
c) have planned
d) had been planned.

37. Voltage _________ by using a voltmeter.

a) measures
b) is measuring
c) had measured
d) is measured

38. A student would have difficulty making a letter correctly unless he has a clear mental picture of the letter.

a) if he has
b) if he had
c) unless he had
d) if he doesn't have

39. Atoms with only one valence electron are the best electrical conductors, __________ copper is a good conductor.

a) because
b) so
c) as
d) but

TECHNICAL GRAMMAR (continued)

40. The draftsman is __________ important person that his mistakes cause his company to loose money.

a) an
b) an such
c) such an
d) so

41. Electrons in the outer orbits of an atom are "free" electrons and may be easily forced from their orbits. They are attracted to the nucleus by __________ force than electrons whose orbits are near the nucleus.

a) less
b) lesser
c) greater
d) more

42. When the big block of ice that __________ Europe in the ice age began to melt, forests began to appear.

a) have covered
b) had been covered
c) had being covered
d) had covered

43. The VOM is used to measure voltage, resistance and current. It is called a Multimeter __________ it has multiple uses.

a) while
b) when
c) so
d) because

44. A little knowledge can be a dangerous thing and if something can go wrong, it __________.

a) will
b) should
c) had
d) would

45. Working with electricity is __________ dangerous that the safety rules should be followed at all times.

a) so
b) very
c) too
d) such

46. Technical drawings that are not clear and accurate are difficult to read; __________, a good draftsman draws cleanly and accurately.

a) when
b) while
c) because
d) therefore

47. Thomas Edison invented the light bulb in 1879. Since then, men __________ many new electrical improvements.

a) made
b) have made
c) is made
d) have been made

48. The American system place the top view above the front view. The European system, does the opposite. It places the top view __________ the front view.

a) on
b) below
c) over
d) in

49. "Why can't I use this meter?" "Because it's __________ that doesn't work now."

a) the only one
b) only one
c) only of one
d) only the one

TECHNICAL GRAMMAR (continued)

50. The directions say to draw an arc on either side of the triangle. The triangle is ______ the arcs.

a) around
b) between
c) right of
d) left of

DICTATION

EST 1. A volt is the unit of electrical pressure or potential./ Voltage is measured by using a voltmeter./ Voltmeters have a high internal resistance/ and are always connected in parallel/ with a circuit or component such as a resistor./ The polarities marked on the meter terminals/ must be observed to obtain a positive meter reading./ If the connections are reversed/ the pointer will deflect in the reverse direction./ The ampere is the unit of electric current./ Current is measured by using an ammeter./ Ammeters have low internal resistance/ and are always connected in series/ with a circuit or component such as a resistor./

EST 2. Potential difference is necessary/ to produce electrical current./ The number of free electrons that can be forced/ to drift through the wire to produce the moving charge/ depends upon the amount of potential difference across the wire./ With more applied voltage the forces of attraction/ and repulsion can make more free electrons drift/ producing more charge in motion./ A larger amount of charge moving with the same speed/ means a higher value of current./ Less applied voltage across the same wire/ results in a smaller amount of charge in motion/ which is a smaller value of current./ With zero potential difference across the wire/ there is no current./

EFL 1. Every school child today knows how to tell the time./ It seems hard to believe that early man/ had no way to tell time./ In order to tell when things had happened/ men had to learn to measure the passing of time./ Men learned to measure a year by the time/ that it took for the earth to go through the seasons./ They learned to measure a day/ by the time it took the sun to travel across the sky./ Long after men could tell one day from another/ they could still not measure the time within a day./ Now we can measure our days in seconds, minutes and hours./ We have clocks to tell us the time of day./ We can measure our years in days, weeks and months./ We have calendars to tell us the time of year./

DICTATION (continued)

EFL 2. In cities in the United States/ there are clocks in most stores, factories and other buildings./ Radio announcers give the correct time during the day./ People here think that it is important to know the time./ Most Americans have watches./ They want to do certain things at certain times./ They don't want to be late./ Time is not so important to people everywhere./ Suppose you visit a country in South America./ You would find that people living there do not like to rush./ If you had an appointment with someone/ the other person would probably be late./ He would not want to arrive on time./ In South America/ even the radio programs may not begin right on time./ Nor do the men on the radio think it important to announce the exact time./ In South America many people think of a clock as a machine./ They feel that a person who does everything on time/ lets a clock run his life./ They don't want a clock or any machine/ to have that much power over their lives./

CLOZE

EST 1. The VOM (Volt-Ohm-Millimeter) is the instrument used most often by the technician. It is used to measure voltage, resistance, and current; and because of this multi-usage is also called a Multimeter. In electronic shops and _____ industry, you will hear it called _____ VOM or Multimeter.

It is important _____ the student of electronics learn this _____ and how to use it correctly _____ safely. What bread and water are _____ the human, the VOM is to _____ technician. You must learn to read _____ scales, where to connect the meter _____, how to position the range and _____ switches, and how to measure voltage, _____ and current.

Voltage is an electromotive _____. It is the force from a _____ or generator that drives our radios _____ electrical appliance. Voltage is the force _____ causes current to flow. Voltage is _____ in volts.

Current is the movement _____ electrons through the wire. This movement _____ forced by the voltage. Current is _____ in amperes or milli-amperes.

Resistance _____ the opposition to current flow. It _____ measured in ohms.

EST 2. Two cases of zero potential difference and no current can be considered in order to emphasize the important fact that potential difference is needed to produce current. Assume a copper wire to be _____ itself, not connected to any voltage _____, so that there is no potential _____ across the wire. The free electrons _____ the wire can move from atom _____ atom, but this motion is random, _____ any organized drift through the wire. _____ the wire is con-

CLOZE (continued)

sidered as a _____, from one end to the other, _____ current is zero. As another example, _____ that the two ends of the _____ have the same potential. Then free _____ cannot move to either end, because _____ ends have the same force, and _____ is no current through the wire. _____ practical example of this case of _____ potential difference would be connecting both _____ of the wire to just one _____ of a battery. Each end of _____ wire would have the same potential _____ there would be no current. The _____, therefore, is that two connections are _____ to two points at different potentials _____ order to produce current.

EST 3. There are many kinds of tools. _____ useful kind is the screwdriver. There _____ two types of screwdriver but both _____ have the same purpose: to tighten _____ loosen screws. The type used for _____ or loosening Phillips-head screws is _____ the Phillips screwdriver. The one which _____ and loosens standard screws is the _____ screwdriver. No matter which type is _____, the process is the same. It _____ very important to select the correct _____ size for the particular job you _____ going to do. The screwdriver must _____ the screwhead exactly. If the screwdriver _____ is too small or too large _____ the head of the screw it _____ probably damage it. Once the correct _____ size has been selected, the screw _____ be tightened by turning it clockwise. _____ loosen the screw, on the other _____, turn it in a counter-clockwise _____.

Wrenches, another type of tool, come _____ a variety of shapes and sizes. _____ screwdrivers, wrenches are used to make _____ tighter or looser. They are used _____ tightening nuts and bolts. One of _____ most important types of wrench is _____ at both ends and is called _____ open-end wrench for that very reason. _____ either end of this kind of _____ may be put to use, it ___ said to be reversible. The box-end _____ almost always has two sides too. _____ the open-end type, it is reversible-- _____ is a useful end on either _____ of the handle.

EFL 1. From here to there

Long, long ago, there was no way to tell time. There were no clocks. There were _____ calendars. There were no rulers, either. _____ did not think about how long _____ how wide anything was until they _____ to own land. Then, many kinds _____ measurements were needed.

To own land, _____ man had to know where his _____ ended and someone else's began. To _____ a house, he had to know _____ big to make it. To trade _____ goods for things he wanted, he _____ to know how much his things _____ worth. To know when to plant _____ crops, he had to have some _____ of telling time.

CLOZE (continued)

Little by little, _____ learned to measure to find out _____ things he needed to know.

EFL 2. Half Go Hungry

There are over two billion people in the world. Each day, around 324,000 babies are _____, and the world's population grows larger. _____ the present time, there is not _____ food for everyone. More than half _____ world's population does not get enough _____ the right kinds of food to _____ healthy. About 10,000 people in the _____ die of hunger every day.

Trying _____ feed the world's billions is a _____ task. It is a job too _____ for some nations working alone. It _____ a job for many nations of _____ world working together. With the help _____ modern science, tools, and machinery, many _____ can be helped to grow more _____.

Over sixty countries have joined together _____ form the Food and Agriculture Organization _____ the United Nations. These nations work _____ to fight hunger.

The Food and _____ Organization searches for new and better _____ to grow food. It helps fight _____ and plant diseases. It sells seed _____ farmers at low cost. It works _____ turn deserts and waste lands into _____ lands. It helps to improve the _____ of the world's peoples. It sends _____ of agriculture into those countries that _____ help.

EFL 3. Science and Technology

There is little doubt that science and technology are closely related. In fact, technology is based on _____ knowledge. Scientists are constantly discovering new _____ and gathering additional information about matter _____ energy. Putting these principles and information _____ use is technology.

Although science and _____ are usually closely related, improvements in _____ do not necessarily require a great _____ of scientific knowledge. In ancient times, _____ example, the wheel was used. The _____ of the wheel was a great _____ advance. Pulleys and windmills were invented _____ used long before the term scientist _____ into use.

Modern technology seems to _____ getting more and more dependent on _____ scientists. Scientists have been the key _____ in several examples of modern advances _____ technology. For example, computers, atomic reactors, _____ lasers were developed by teams of _____.

Reading Comprehension EST

The human ear can hear a wide range of sounds. This range is measured in units called decibels. The sound of a whisper has a decibel level of 20, and the sound of conversation has a decibel level of 60, and the sound of an airplane is about 110 decibels. Sound becomes noise (and can begin to damage your hearing) when it goes above 86 decibels. Of course sounds below 86 can be called noise when they interrupt other sounds and are unwanted. Doctors have found that electric guitars and other amplified instruments may produce decibel levels from 90 to 105. These levels, according to some doctors, can begin to cause deafness in the musicians and their listeners.

1. Which of these does <u>not</u> define noise?

    1. a sound above 86 decibels
    2. sound that is unwanted
    3. a sound that interrupts other sounds
    4. a sound with a wide range

2. What does "unit" mean in this passage?

    1. an amplified guitar
    2. a fixed amount
    3. a noise
    4. an inch

3. If something had a decibel level of 60 it would <u>not</u> be:

    1. a sound
    2. a noise
    3. a cause of deafness
    4. unwanted

4. The decibel level at which a sound can be called a noise is:

    1. not exact and absolute
    2. determined by doctors
    3. 105 decibels
    4. the decibel level of airplanes

A phonograph is a thin, flat plastic disk in the shape of a circle. Sound is recorded on a phonograph record in one long spiral groove. Sound results from the movement of waves in air. These movements, or vibrations, direct a sharp knife-like cutter that scratches a wavy groove into the plastic disk. The cutter moves in a continuous path around the disk from the edge to the center. The patterns of the waves in the groove change as the pitch and loudness of the sound change. When the disk is played on a phonograph at the same speed at which the sound was recorded, the waves in the groove make the phonograph needle and arm vibrate. An amplifier is used to make these vibrations strong enough to hear as sound.

5. A phonograph need all of the following to make sound <u>except</u>:
    1. The record moving at the same speed that the cutter moved
    2. an amplifier

3. a knife
4. air

6. If the patterns of the waves in the grove do not change, the sound on the record will:
   1. be louder and higher than normal
   2. not change
   3. not be heard without an amplifier
   4. need a sharper phonograph needle to make the sound change

7. The word "spiral" in this passage means:
   1. circles inside each other
   2. an unending line
   3. a cut
   4. a path that circles around in smaller and smaller circles like a coil

8. The function of the amplifier is to:
   1. create vibrations
   2. increase the strength of the vibrations
   3. change the groove pattern
   4. make the disk more strong

Matches are called safety matches when they can be lit only by rubbing them against the striking surface on the outside of the box in which they are packaged. The match "lights" because there is a reaction between the chemicals in the head of the match and the chemicals on the striking surface of the box.
The composition of the match head includes a chemical that carries oxygen, such as lead oxide; a chemical that is inflammable, such as sulfur; and substances that cause friction, such as powdered glass. Glue-like elements bind everything together.
When the head of the match is rubbed against the striking surface, friction causes heat on a small area of the head. The heat frees the oxygen from the chemical carrying it, and the oxygen joins with the sulfur to form sulfur dioxide. This causes more heat, which in turn causes more oxygen to be freed and to be combined with sulfur to make more sulfur dioxide. The chemical process is so fast that the match appears to catch fire all at once.

9. A safety match needs all of the following to light <u>except</u>:
   1. a chemical that carries oxygen
   2. coloring matter
   3. the striking surface of the box
   4. friction

10. What does "composition" mean in this passage?
    1. a written page
    2. a combination of things
    3. the shape of the match head
    4. powdered glass

11. What does "striking surface" mean in this passage?
    1. the box
    2. the outside part of the box
    3. cardboard

4. the label

12. The purpose of this passage is to:
    1. describe how a safety match works
    2. warn against unsafe matches
    3. list the chemicals in safety matches
    4. describe how oxygen combines with sulfur

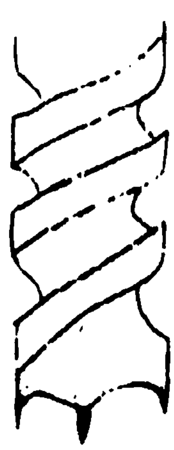
During a radio broadcast or tape playback, the level meter indicates the condition of the batteries. If the pointer is in the GOOD range, the voltage is sufficient. If it is in any other position, all the batteries should be replaced with new ones. If the batteries are weak, slow tape speed, sound distortion or low volume will occur.

13. The level meter operates only:
    1. if the batteries are weak
    2. when the set is on
    3. when the pointer indicates GOOD
    4. when there is sound distortion

14. Slow tape speed and sound distortion are the result of:
    1. low volume
    2. sufficient voltage
    3. tape playback
    4. battery weakness

15. The condition of the batteries can best be determined by:
    1. the range the LEVEL meter pointer is in
    2. volume
    3. visual inspection of them
    4. distortion

16. If the pointer is outside the GOOD range:
    1. voltage is sufficient
    2. tape speed will improve
    3. batteries should be replaced
    4. the batteries are okay



Drills for wood or metal differ slightly in their shape, but their mode of action is almost identical, whether operated by hand or electrically powered. The wood drill (or bit) has a screwlike part at its center which drives into the wood and pulls the cutting edges after it. The cutting section approaches the wood with two sharply pointed knife edges that spear straight down into the wood and cut through the fibers in the cross grains so that they won't splinter. The cutting edges themselves, two knives which turn and slant into the wood, clean out all the wood between the spearing blades and carry it up along the twisted path on the body of the drill.

17. Which part of the bit enters the wood first?
    1. the cutting edges followed by the screw-like part
    2. the drive

3. the screw-like part at the center
4. the knife edge

18. Wood drills are powered:
    1. always by hand
    2. always by electricity.
    3. sometimes by hand, sometimes electricity
    4. by the bit.

19. Wood and metal drills are:
    1. different in shape and mode of action.
    2. a little different in shape but much the same in action.
    3. different in action but identical in shape.
    4. exactly the same in shape and action.

20. The passage is:
    1. about wood drills and metal drills equally.
    2. mainly about metal drills.
    3. is concerned with all types of drills.
    4. is mainly about wood drills.

Metal drills don't need the spearlike parts since metal has no grain and it will be cut smoothly just by the sharpened drill end. Usually the metal drill scrapes away the material at the very center of the hole and cuts it away out toward the periphery. It is driven into the metal by very high pressures and speeds in the drill press or even by hand-held electric drills. A hole larger than ¼ inch is usually made by first drilling a smaller hole and then finishing with a drill of the desired hole size.

21. Drilling a hole larger than ¼ inch in metal requires:
    1. spearlike parts
    2. the use of more than one drill bit
    3. a special drill press.
    4. no grain

22. The spearlike parts found on wood drills are:
    1. unusual on metal drills
    2. characteristic of metal drills
    3. not a part of metal drills
    4. needed on all metal drills

23. Is there any reference made to wood drills in this passage?
    1. Yes, indirectly, in sentence number one.
    2. No, there are no references at all.
    3. Yes, there are references made throughout.
    4. Yes, there is a reference made in the last sentence.

24. One function of a drill besides simply drilling is:
    1. determining a hole size
    2. measuring
    3. waste removal while drilling
    4. avoiding high pressure

3. secondary cells
4. automobile batteries

30. Secondary cells are:
    1. non-rechargeable and expensive
    2. expensive and rechargeable
    3. inexpensive and rechargeable
    4. inexpensive and non-rechargeable

31. This paragraph is concerned with a comparison between:
    1. D cells and other flashlight batteries.
    2. expensive and inexpensive types of batteries.
    3. primary and secondary cells.
    4. automobile and flashlight batteries.

32. Which of the following adjectives describes an automobile battery?
    1. secondary, non-rechargeable
    2. primary, rechargeable
    3. rechargeable, secondary
    4. non-rechargeable, primary

Reading Comprehension EST (continued)

The important thing to remember when wielding a hammer is that the speed of the hammer head, not your muscle, is what gives maximum impact. It is more important to get a good stroke well placed than it is to get a roundhouse blow. Try to strike the nail with the hammer handle parallel to the work at impact. This means that your hand will be just a little farther away from the surface of the wall or cabinet than you would normally think is right. But by keeping the hammer face flat on the nail head on impact, the nail will drive true and straight rather than off to one side--and there's no wasted power. Also try to keep in mind that it is the head of the hammer doing the work, not the arm. Give it a good rotating swing from the elbow, not necessarily from the shoulder.

25. The best distance between the hand and the surface being worked on is:
    1. twice the length of the hammer.
    2. less than most people think.
    3. as near as possible.
    4. more than most people think.

26. To use a hammer with greatest efficiency:
    1. a good roundhouse blow is important.
    2. your hand should be close to the work surface.
    3. speed and accuracy of stroke are important.
    4. maximum muscle power is most important.

27. Which of the following does <u>not</u> lead to wasted power when hammering?
    1. depending upon muscle strength
    2. keeping the hand very close to the object being hammered
    3. use of roundhouse blows
    4. use of a rotating swing from the elbow

28. Which of the following does <u>not</u> contribute to maximum hammer impact?
    1. selection of the heaviest hammer available
    2. hammer head speed
    3. keeping the hammer parallel to the work at impact
    4. greater distance from the surface than you would normally think correct

A cell produces electricity by chemical means. That's the basic definition. The many available types have been divided into general kinds--primary and secondary. Those cells that are not rechargeable (flashlight D cells, for example) are primary cells, and those that may be recharged (automobile batteries) are secondary cells. The primary cell is disposable. It is so inexpensive that you can afford to throw it away and buy a new one when the old one has been drained. The secondary cell is rechargeable. When drained of current, it can be recharged by applying an external voltage supply to the terminals and reversing the chemical action that took place during discharge.

29. Cells that are not rechargeable are called:
    1. primary cells
    2. flashlight cells